Rough visual cross-check of distance between target can of MET-01 and horn PH1-04 for NuMI 2014 Run

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- The target and horn for NUMI are installed with separation known to order 2 mm accuracy, using distances to precision tooling balls. The process involves combining the result of five separate measurements (fiducializations and installation surveys). As installation is done blind under some cross-beams, with only tooling balls visible, there was no direct visual confirmation of the gap between target can and horn. Recent data motivated doing a visual check.

- On 10/14/2014, a remote camera was inserted into the NUMI target pile to get a rough visual confirmation that the installation survey numbers were correct. The borescope camera operator was Keith Anderson.

- The diameter of the downstream Beryllium window on the target can is 14 cm. In two pictures in this document, the diameter of that window is used to scale the distance between the target canister and the upstream end of the horn.

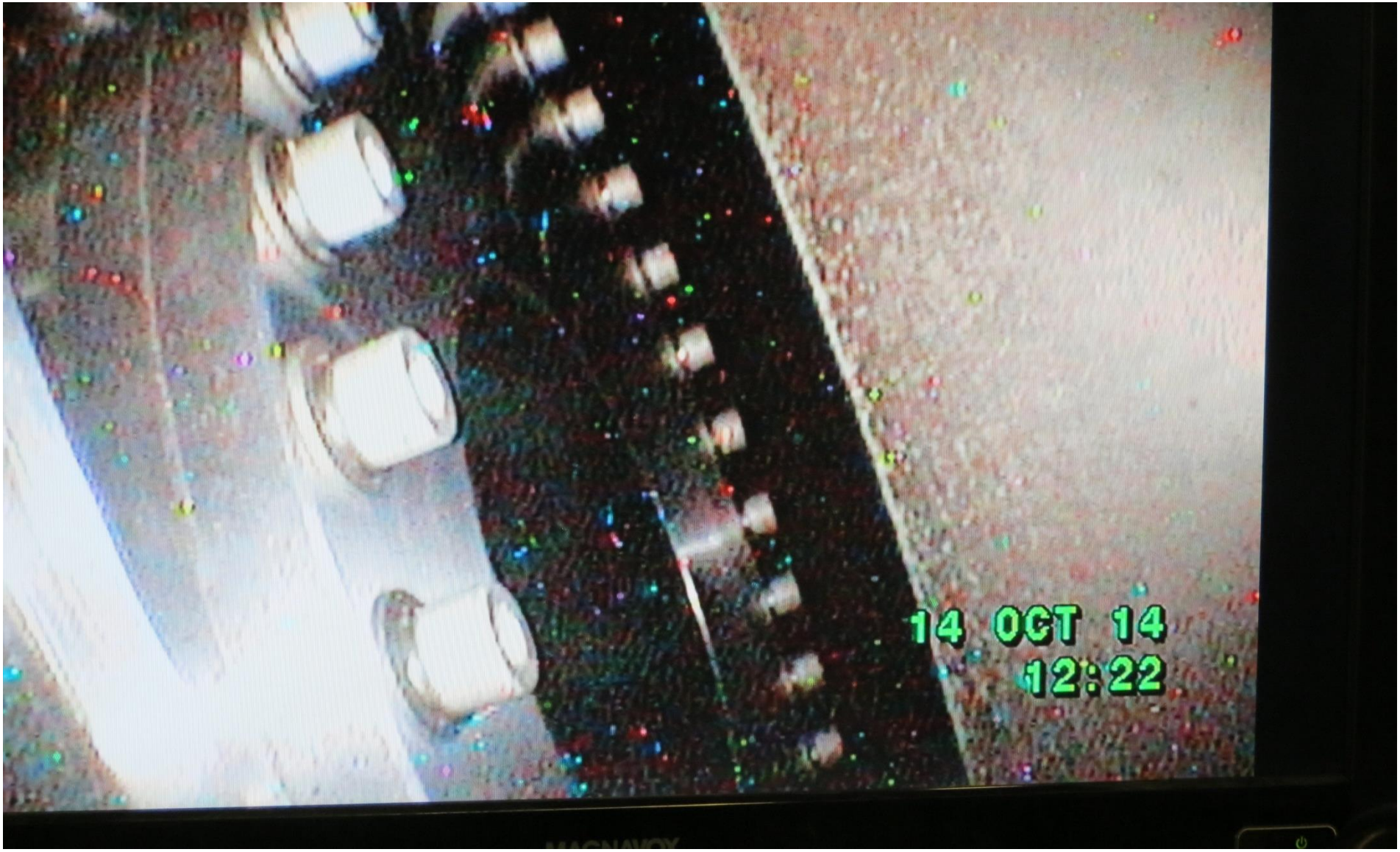


Photo IMG_2594 of MET-01

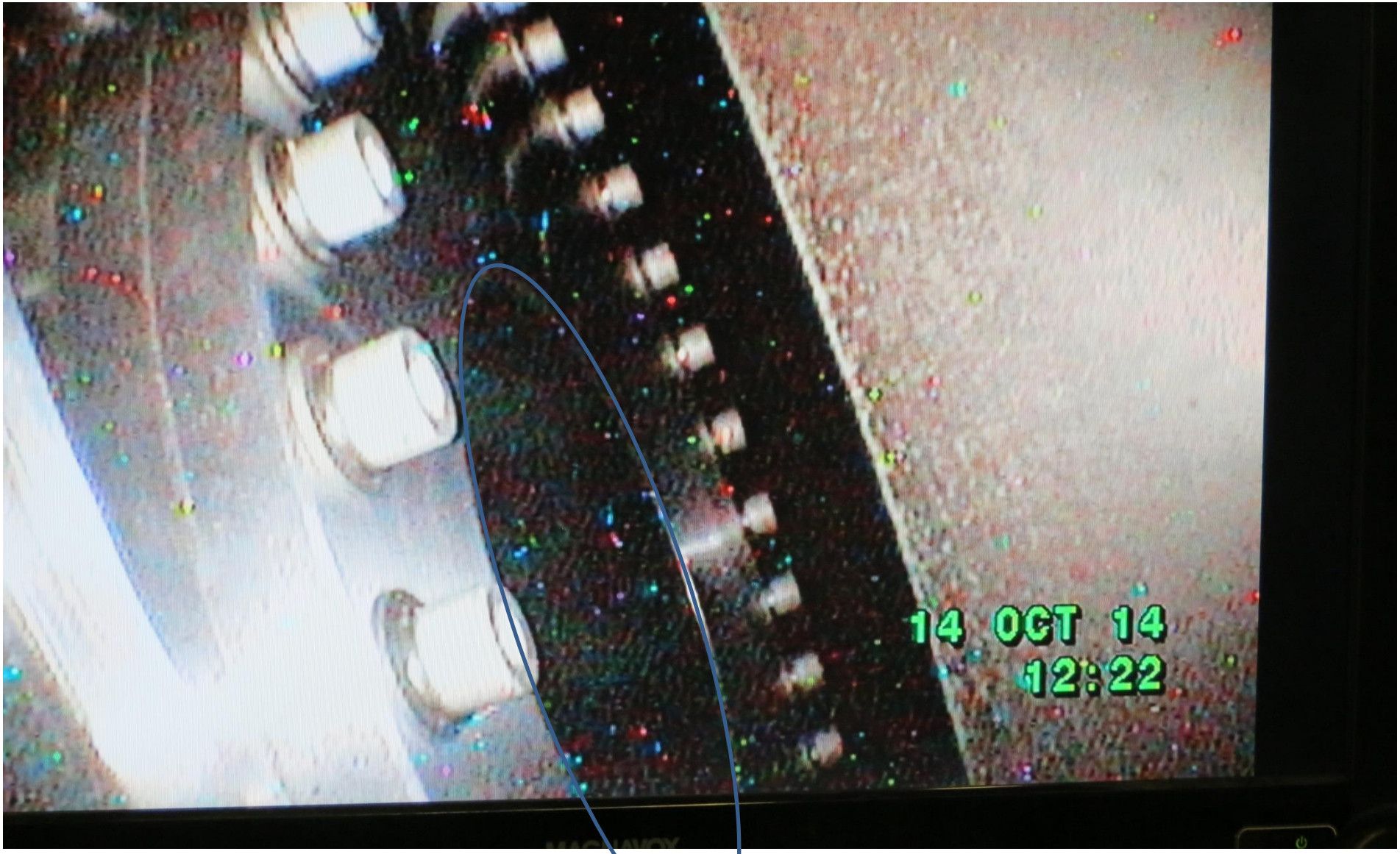


Photo IMG_2594 of MET-01 with ellipse around beryllium window

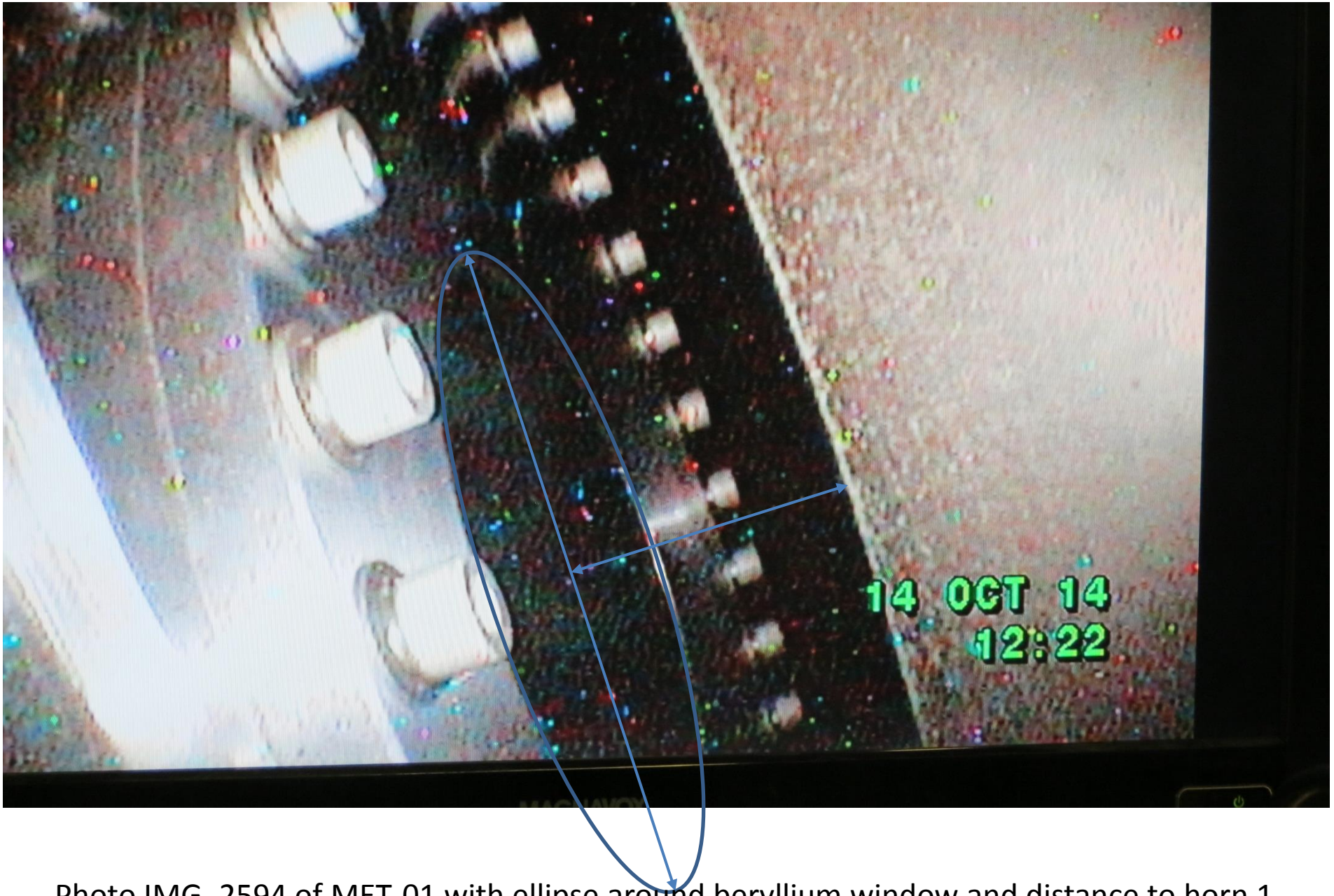


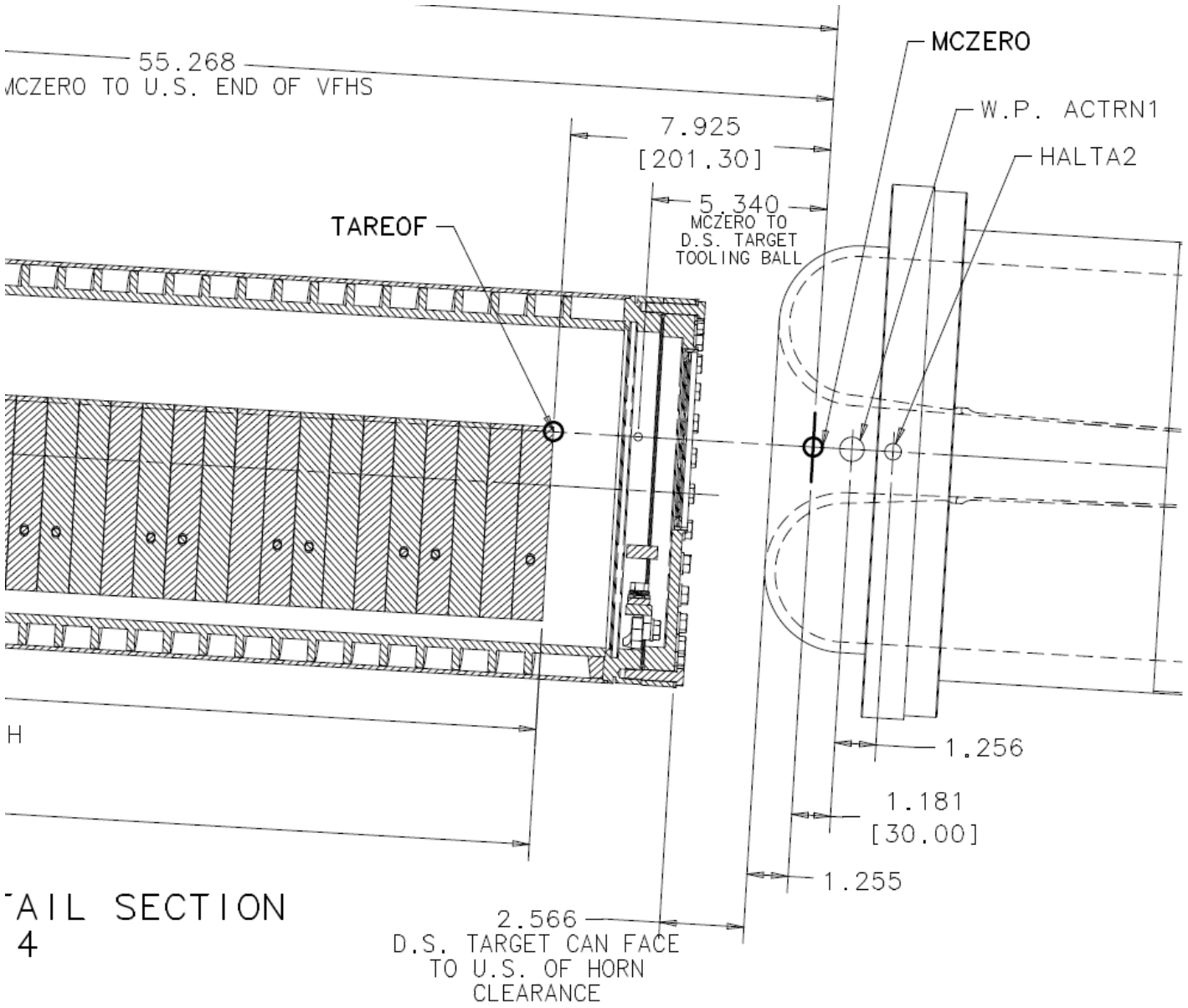
Photo IMG_2594 of MET-01 with ellipse around beryllium window and distance to horn 1

Photo 141014AE of MET-01

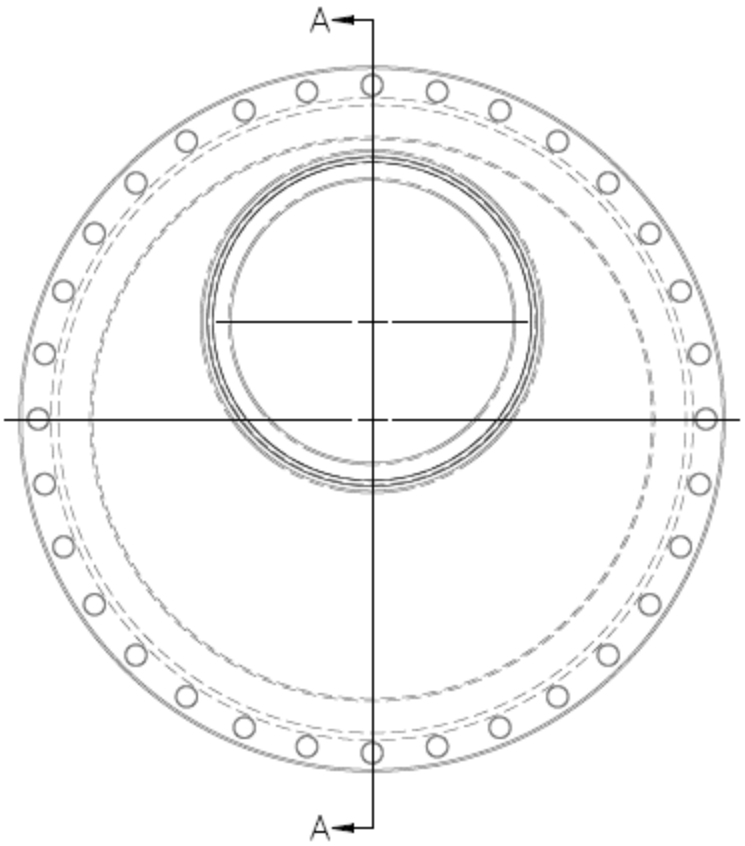
Photo 141014AE of MET-01 with ellipse around beryllium window

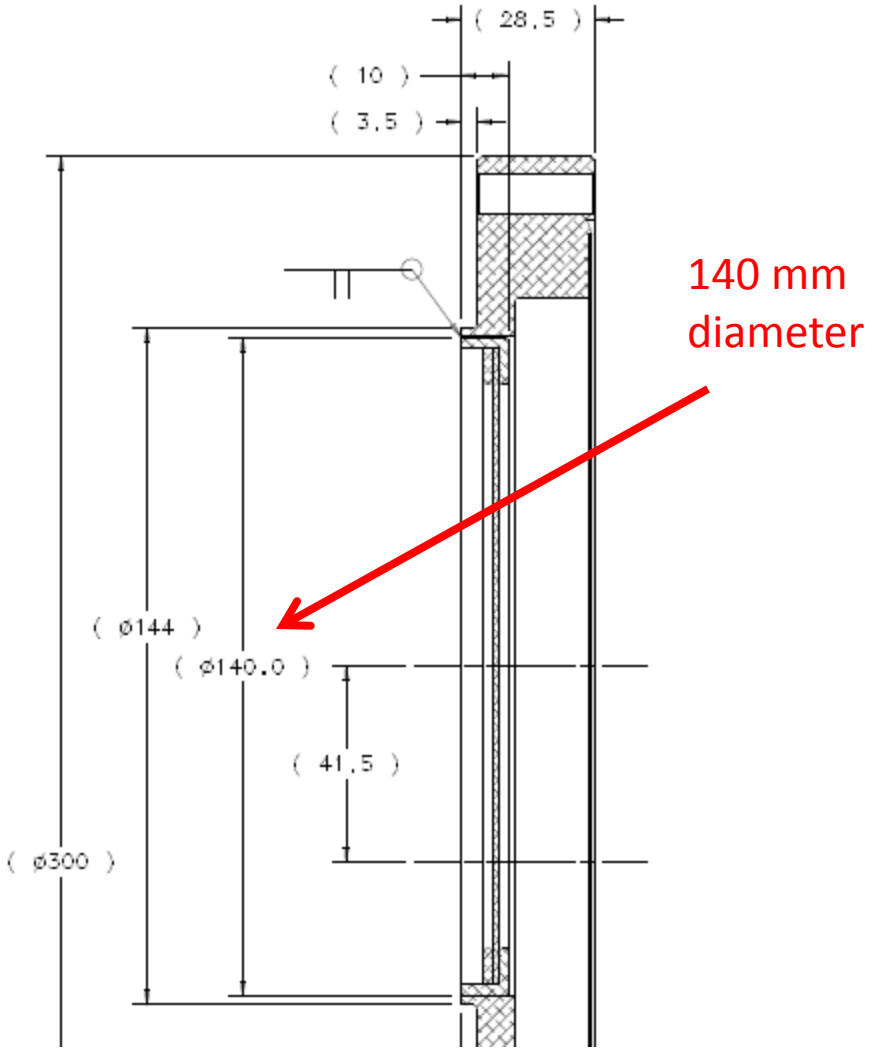
Photo 141014AE of MET-01 with ellipse around beryllium window and distance to horn 1

From integration plan drawing ME-433995



Beryllium window diameter on MET-01 downstream flange from drawing ME-433714





Comparison of visual estimate with expected gap

Derivation of visual estimated gap from photos:

known diameter	ratio of features	derived distance	derived distance	
cm		cm	inch	
14	def. 100%			diameter of Be window
	43%	6.00	**2.36**	**center of ellipse to horn, 1st photo**
14	def. 100%			diameter of Be window
	41%	5.68	**2.23**	**center of ellipse to horn, 2nd photo**

Derivation of expected gap from survey and integration drawing:

cm	inch	
	2.566	integration plan distance window to horn
20.13		integration plan fin end to MCZERO
19.43		installed survey fin end to MCZERO
-0.7	-0.28	delta installed versus planned
	2.29	**expected clearance**

Given the technique and that the lighting did not well display the entire window on a single picture, would not be surprised by error ~ 10% or 15%.

But there is certainly visual agreement at that level with expected gap